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MT. SHASTA TREE NURSERY

SHASTA - TRINITY NATIONAL FORESTS

U.S.D.A. - FOREST SERVICE

CALIFORNIA REGION

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MT. SHASTA FOREST TREE NURSERY

By

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1. WHY HAVE A FOREST TREE NURSERY?

This nursery grows young trees for planting on the 17 National Forests in California. Large fires frequently kill all parent trees that could supply the necessary seed to start a new forest on the burned land. In such cases the forester must aid nature by planting small trees to fill the openings. Unless this is done promptly, undesirable brush will fill the openings that should be growing trees.

Each year 5,000,000 little trees are needed to repair the scars left by forest fires on national forests alone. The trees are planted about 8 feet apart which means 680 trees to the acre. At this rate 5 million trees will plant 7,000 acres. The areas burned each year on national forests often total many times this 7,000 acres. However, many of the acres burned have shallow soil too poor to grow timber. Such areas are not planted to trees. The brush resprouts or in many cases a grass crop is seeded to cover the bare ground on thin mountain soils not suitable for trees.

Planting of the 5 million trees from this nursery only meets the need to keep even with the fire loss each year. Over a million acres of unstocked forest soil remains as a backlog to be planted on the national forests. Tree nurseries are necessary to foresters, just as a needle and thread are essential to a housewife.

2. WHO OPERATES FOREST TREE NURSERIES IN CALIFORNIA?

Most of the trees needed for planting national forest land are grown at the Mt. Shasta Nursery located nine miles east of McCloud on Highway 89. It ships 3-1/2 million trees a year direct to the Forests. In addition it grows 1-1/2 million trees that are shipped south, when one year old, to the Oakdale Nursery in Stanislaus County. There they are transplanted for an additional year's growth until ready for shipment to the Forests in the southern half of the State. This helps take care of the difference in planting seasons in such a long State as California.

*Photographs by C. J. Szukalski

AGRICULTURE—FOREST SERVICE—SAN FRANCISCO

Trees needed for planting on private land, such as on tree farms or by Christmas tree growers, are raised by the California Division of Forestry, Office Building One, Sacramento, California. The State prints a price list each year giving the species available and price per dozen, hundred or per thousand trees. They have four nurseries which are located at Davis, in Yolo County, at Magalia in Butte County, Ben Lomond in Santa Cruz County and Parlin Fork in Mendocino County. Stock is offered at reasonable cost to encourage tree planting on private land for forest production and erosion control. Trees for landscaping are offered by most commercial nurseries in California.

3. HOW ARE TREES GROWN IN THE NURSERY?

(a) Tree seed required

For each tree grown there must be a seed planted. It takes lots of seeds to grow five million trees each year. In fact it takes 1-1/2 tons of tree seed each year. (3,000 lbs.).

(b) Seed collection

An important first step to the nurseryman is keeping a supply of seed on hand. He must have the several species used and from the proper locality or seed zone. About every three years there is a good seed crop and every five to eight years a bumper crop. The years in between offer little opportunity to gather cones to extract the seed. A three to five year supply of seed is kept in storage, plus seed used for direct seeding in the woods. About September 1 to 15 the cones start to ripen and for the next thirty days, warm dry winds cause the cones on the trees to open. This lets the seed scatter in all directions. Cones must be picked after the seed is ripe and before they open and lose their seed.

Anyone interested in picking and selling ripe cones to the Forest Service in September should see the Forest Ranger or Nurseryman for details and prices. Cones are picked from felled trees on going timber sales or by climbing trees. To test for ripeness, cut some cones lengthwise with an ax. If the seed kernel is white, solid and starchy, not watery or milky, and the seed coat is turning brown, the seed is ripe and ready to gather. If it is milky, it will spoil and will not germinate when sown in the nursery. Species and seed zone must be tagged on each sack. This is important.

(c) Extraction

Hot sun or careful drying with artificial heat will open the cones and the seed will fall out with wings attached. A special machine at the nursery dewings the seed and cleans it.

1. Opening Jeffrey Pine Cones With Sun's Heat

(d) Seed storage

Seed should be dry to keep well. (6 to 10 percent of oven dry weight at 214 degrees F) It is stored in air-tight cans to keep moisture out. The seed storage room is kept at 34° F and will keep the seed usable for 10 years or more.

(e) Seed zones

The forested area of California is divided into 13 seed zones of comparable growing season, rainfall and snow conditions. If a fire burns timber on the east side of the Sierras and north of Lake Tahoe, the forest orders Ponderosa or Jeffrey pine from seed zone I. This assures planting stock grown from seed collected from the same area. Tests have shown these trees will be most adaptable to the low rainfall and late spring frosts common to this zone. Hence it is important to keep each bed in the nursery labelled as to species, seed zone and date planted or transplanted. A nursery-man must keep lots of records or else his stock becomes hopelessly mixed up.

(f) Classes of stock

There are two classes of stock - seedlings and transplants. The following nursery "short-hand" indicates age and class of stock.

1-0 Means one year in seed bed and no years transplanted.
2-0 Means two years in seed bed and no years transplanted.
1-1 Means one year in seed bed and one year in transplant bed.
1-2 Means one year in seed bed and two years in transplant bed.

Other combinations are possible.

1-1 Is the most common class used, as it gives a sturdy two-year old plant with a spreading root system of several forking roots.
2-0 Is also a two-year old plant, but because it was not transplanted from its original seedling bed, it has only a main taproot and some laterals. For severe planting spots the sturdy 1-1 class of tree often gives best results. 2-0 Stock can be used on the better sites.

(g) Species planted

Ponderosa pine is the most common one used. Jeffrey pine can usually be substituted for ponderosa but not vice versa. Jeffrey is generally found growing at higher elevations than ponderosa or on poorer sites. For example, Jeffrey is less likely to bend over with heavy snow loads. Some sugar pine is raised for planting in areas selected for sugar pine management and protected from blister rust. The McCloud nursery area is kept free of gooseberry and currant plants because they carry the blister rust disease to the sugar pine. Other species such as Douglas fir, red and white fir, incense cedar and Sierra redwood are grown in varying amount.

(h) Relation of seed to trees required.

Tree seeds vary in size for each species. They are listed in decreasing size.

Species	Number of Seed Per Pound	Pounds of Seed To Produce 680 1-1 Plants to Plant 1 Acre	Number of Plantable 1-1 Trees Per Pound of Seed	Pounds Seed to Seed Spot an Acre, 3 Seed Per Spot, Spaced 6 Feet by 6 Feet
Sugar pine	2,000	0.68	1,000	1.8
Jeffrey pine	4,000	0.36	1,900	0.9
Red fir	6,600	0.68	1,000	0.3
Ponderosa pine	10,000	0.21	3,200	0.4
Incense cedar	15,000	0.27	2,500	0.4
White fir	16,000	0.68	1,000	0.3
Douglas fir	35,000	0.07	10,000	0.2 (5 seed per spot)
Sierra Redwood	91,000	0.14	4,800	0.25 (20 seed per spot)

(i) Sowing the seed

The seed beds are four feet wide, 400 feet long and will produce 60,000 to 80,000 seedlings. The seed is sown in drills, 8 rows to the bed. Density of seedlings per square foot is 40 to 50 plants. The specially built seeding machine will drill a 400 foot bed in about thirty minutes. No hand work is needed. No burlap or straw cover is used. Lath snow fence provides shade and frost protection to sugar pine, Douglas fir, and true firs.

2. Seed Drill For Sowing Forest Tree Seed In Beds

The seed bed is kept moist with the overhead water system and the seed will germinate in 20 to 30 days of warm weather. Most sowing is done in the fall and no seed treatment is needed. If spring sowing is done, the seed is stratified in moist sand and chilled for 50 days at 32° - 38° F. This is especially necessary with sugar pine, Sierra redwood, Douglas fir and true firs. Seed treated in this manner will germinate in 10 days after sowing.

The germinating seed in the seed beds must be watered frequently to induce germination. Constant protection from rodents and birds must be maintained from the time of sowing until the seed coat drops off, about 40 days after germination.

(j) Root pruning and lifting the plants

When the seedlings are one year old, their roots are pruned so they will have a spreading root system. The root pruner consists of a horizontal rigid blade which is pulled by the tractor. It runs 4 inches under ground, cutting off the roots. If the seedlings are to be lifted and transplanted for better spacing and growth a similar blade with spurs is used to break up the soil and loosen the plants. It is run at an 8 inch depth. The trees can then be pulled out of the soil and gently shaken free of excess soil to avoid damaging the root tips. Care is taken to prevent the roots from drying out. Five minutes in the sun will adversely affect their survival.

3. Running A Sharp Blade Under Baby Pines Before Lifting Them

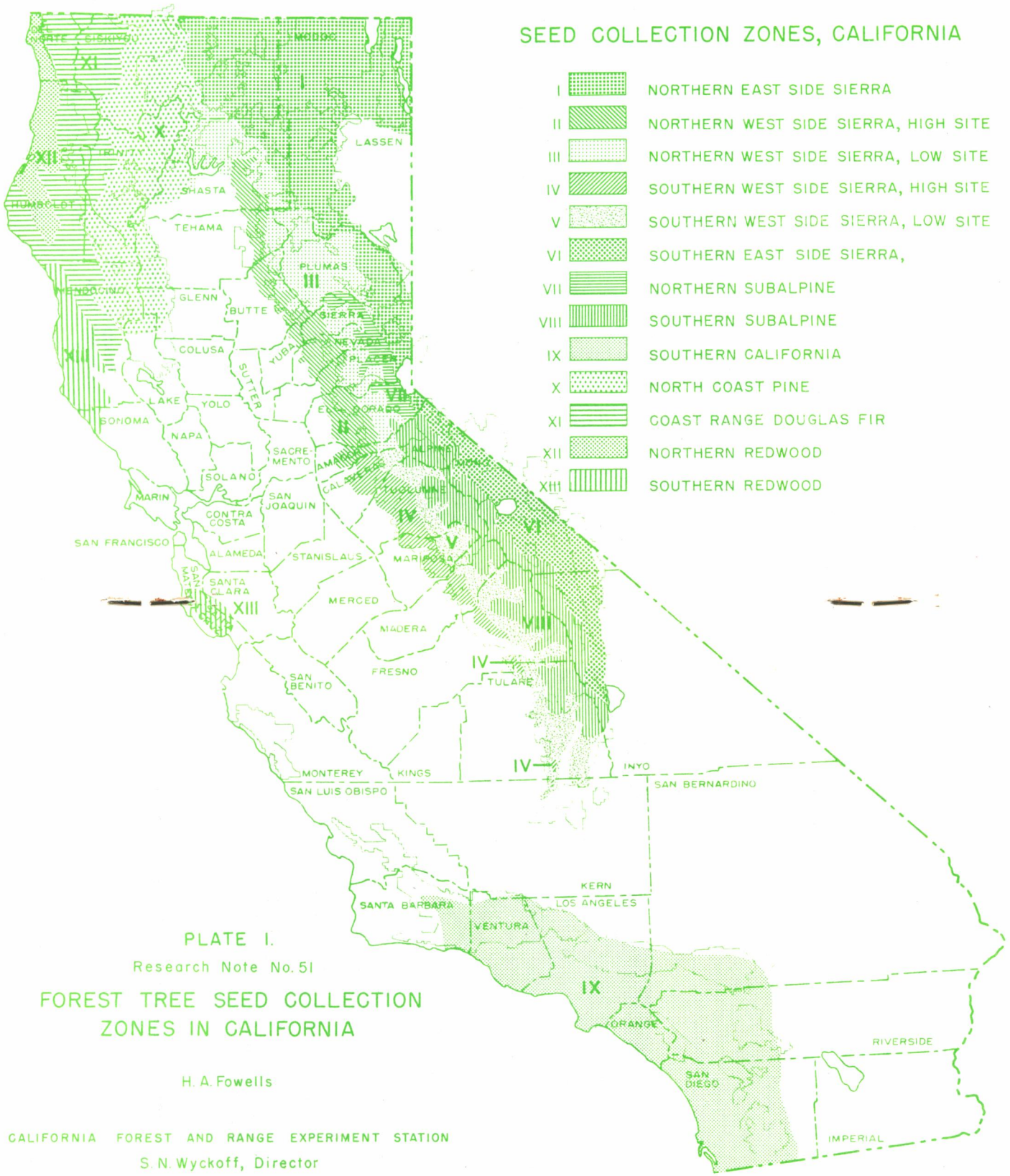


PLATE I.

Research Note No. 51

FOREST TREE SEED COLLECTION ZONES IN CALIFORNIA

H. A. Fowells

CALIFORNIA FOREST AND RANGE EXPERIMENT STATION

S. N. Wyckoff, Director

FOREST SERVICE - U. S. DEPARTMENT OF AGRICULTURE

(k) Transplanting

This is done by machines called Holland Celery Transplanters, which have been modified to handle small trees. The machines are self-propelled and self-steering. Two operators, on one machine, can plant 28,000 seedlings in one eight hour day. About 100 machine days are needed to transplant three million trees each spring. So eight machines are put to work each spring, getting the job done promptly.

Each bed 400 feet long with eight rows of transplants contains 12,000 plants. Of these only about 9,000 plants will grade out as usable 1-1 transplants.

4. Girls Riding Backwards On A Transplant Machine

(l) Watering

An overhead water system of oscillating pipes spray water into the air and it falls like rain. There are 69 overhead pipes with spray nipples, each 400 feet long, totaling five miles in length. Each pipe sprinkles ten beds, or half an acre. A group of seven pipes are cabled together so a powerful water cylinder operated by water pressure can turn them slowly back and forth as they spray. Natural water pressure of 45 pounds per square inch comes from the reservoir in Tate Creek, 3/4 mile south and 120 feet above the nursery.

(m) Soil and fertility

The nursery area was cleared of natural ponderosa pine forest in 1946. It is very good for pine growth. A tree will reach 110 feet in height in 100 years (between site I and II Scale). The deep, sandy loam soil of lava ash and pumice-like material was unknown to the soil classifiers.

They named it "McCloud series." The soil is desirably acid (PH 5.6). Like most California soils it is low in phosphorus. About every other year the soil is chemically tested at Corvallis, Oregon State College Soils Division, where the soils laboratory specializes in forest nursery soils. Depending on the tests, varying amounts of fertilizer are applied. The fertilizer is dissolved in water and distributed through the overhead sprinkling system. The usual amount applied each spring is about 400 pounds of 16-20-0 NPK per acre and 300 pounds of potash (muriate of potash, 0-0-40). The organic content of the soil is kept at 6 to 7 percent by use of cover crops rotating every third year. Florida lupine (sweet blue lupine) is used as it nitrifies the soil and rots promptly when plowed under. The lupine crop is fertilized to get maximum bulk. It requires inoculation of nitrifying bacteria. As soon as the flowers are ready to bloom it is plowed under to avoid getting woody stems.

(n) Weeding

Most of the weeding job is done with a chemical, using a pre-treatment of allyl alcohol in the spring after the soil surface temperature reaches 60°. The alcohol is injected into the overhead sprinkling system. One half acre can be treated in 45 minutes. The fumes are poisonous so only the nurseryman equipped with a special gas mask, is allowed to handle this job. About nine gallons of alcohol per acre will kill 95% of the weed seeds in the soil. Late in the summer a fine seeded weed, Jerusalem Oak (Chenopodium botrys) appears in the beds. These are sprayed and killed with mineral spirits. Care must be taken to avoid hitting the trees.

5. Apparatus For Injecting Weed Killer Spray Into Overhead Sprinkling System

(o) Grading stock

Forest planting conditions in California are considered as tough as any in the United States. Five months without a half inch rain and aggressive competition from brush species makes sturdy planting stock essential. Weak, runty, damaged, poorly shaped trees are culled out by the lifting crew. Only thrifty plantable trees should reach the planting field.

A special machine, designed by Lanquist, is used to help the lifting crew do their important task of grading and counting. It consists of an endless belt shaded from the sun that slowly rolls along, covering five beds at a time. It is pulled by a small tractor. Ten women count and sort out the good trees, dropping the substandard trees on the ground. The good trees with stem diameter of 0.11 inch or more are placed in counted bunches of fifty on the moving belt. As the bunches move to the end of the belt they are placed by counted numbers in a box, covered with a wet burlap and taken to the packing house. No drying of the roots is permitted. Studies by the California Forest Experiment Station show that as little as

five minutes in the sun will damage the tree roots. Only the most careful workers are trained for the lifting crew as they determine whether cripples and runts reach the planters. Care must be taken to keep track of each seed zone, species and class of stock.

6. General View Of Nursery And Mt. Shasta

(p) Packing

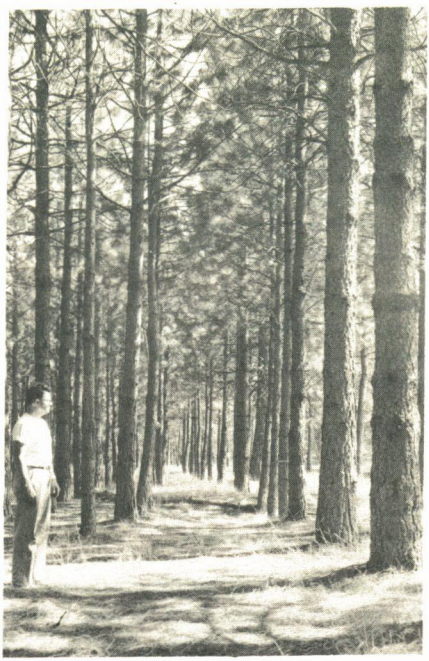
Wooden slat crates 19 inches x 29 inches x 15 inches high are used for packing and shipping the stock. A piece of "Ocean Wrap" paper, treated to prevent molding, is placed in the crate, then a pile of wet packing material in the center where the roots of the first layer of trees will meet. The tops of the trees point toward the ends of the crates. A layer of wet packing material and then a layer of trees goes in, until the crate is full. A 50-50 mixture of fresh pine planer shavings and plaster grade vermiculite (terralite) is used for packing to keep the roots wet. Such material does not mold readily.

However, care must be used to keep packing material away from the needles to prevent blue mold forming while in cold storage. A crate will hold about 1,500 Jeffrey or 2,000 ponderosa 1-1 pine trees. Each crate is plainly labelled as to number of plants, species, seed zone, age class and date packed.

(q) Storage

The snow at Mt. Shasta nursery usually gets six to eight feet deep each winter. By scattering a thin layer of dry soil on the surface early in March, the black blanket helps early snow melting. Fresh lifted stock is usually available by April 1. To supply forests that have earlier planting sites at warmer elevations, about 500,000 trees are lifted in mid-October and placed in cold storage for very early spring use. A specially insulated cold storage building 25 feet x 50 feet with 8 foot ceiling is used. It is designed to store a million 1-1 trees. Temperature is held at 33° F and high air moisture (92 percent R.H.) to prevent the trees from drying out. Even so, it is usually necessary to up-end each crate in January and let the hose run water through the bale. This is repeated always before each crate is loaded in a truck for shipment.

Crates are stacked for storage with spacers in between each crate for free circulation of air. Otherwise mold forms. Electric lights are kept burning as an aid to prevent mold and help keep plants alive. In summer the storage room, circulation system and crates are fumigated with chloropicrin and dried out.



7. Ponderosa Pine Trees Planted 35 Years Ago At Pilgrim Creek On Shasta National Forest. Pruned 5 Years Ago. Some Trees Are 17 Inches Diameter, Breast High

4. FURTHER FACTS ON MT. SHASTA NURSERY

Established: First seeded, fall 1947.

Water supply: Gravity fed from diversion dam on Tate Creek.

Source of labor: Seasonal labor is largely women, from nearby communities of McCloud and Pondosa. Most of them are experienced in the work, returning each season. They have demonstrated their ability to do careful and exacting work with growing plants that can be easily damaged by inexperienced help.

Area: 45 acres gross area, with room for expansion. 32 acres are under overhead irrigation for seed beds and transplant beds. The 4 feet wide beds, each 400 feet long, total 690 beds in number or 52 miles in length.

Capacity to produce trees: 3-1/2 million 1-1 transplants per year and 1-1/2 million 1-0 seedlings for transplanting. This allows 1/4 to 1/3 the area to be in cover crop each year.

Buildings: Dwelling for nurseryman. Dwelling for assistant nurseryman. Warehouse - packing shed. Warehouse - seed storage shed. Equipment shed (proposed). Water tank (10,000 gallons) for fire emergency. Cold storage building for early spring stock. Office building for records. Gasoline station with oil house.

Shipping: Most forests send their trucks directly to the nursery keeping two or three days ahead of their planting crews. They notify the nursery a week ahead of the first truck call.

A stake body truck can haul 54 crates which is 100,000 trees at 2,000 trees per crate.

A pick up truck can haul ten crates which is 20,000 trees at 2,000 trees per crate.

Each truck brings back the empty crates. Also it brings a canvas tarp to cover trees in transit and keep drying winds away. If weather is warm, night driving is scheduled through the hot central valley.

Forests notify the nursery how they want small orders shipped. This is usually by motor express. Fast overnight truck lines run through Mt. Shasta. Pacific Motor Trucking Company serves the nursery.